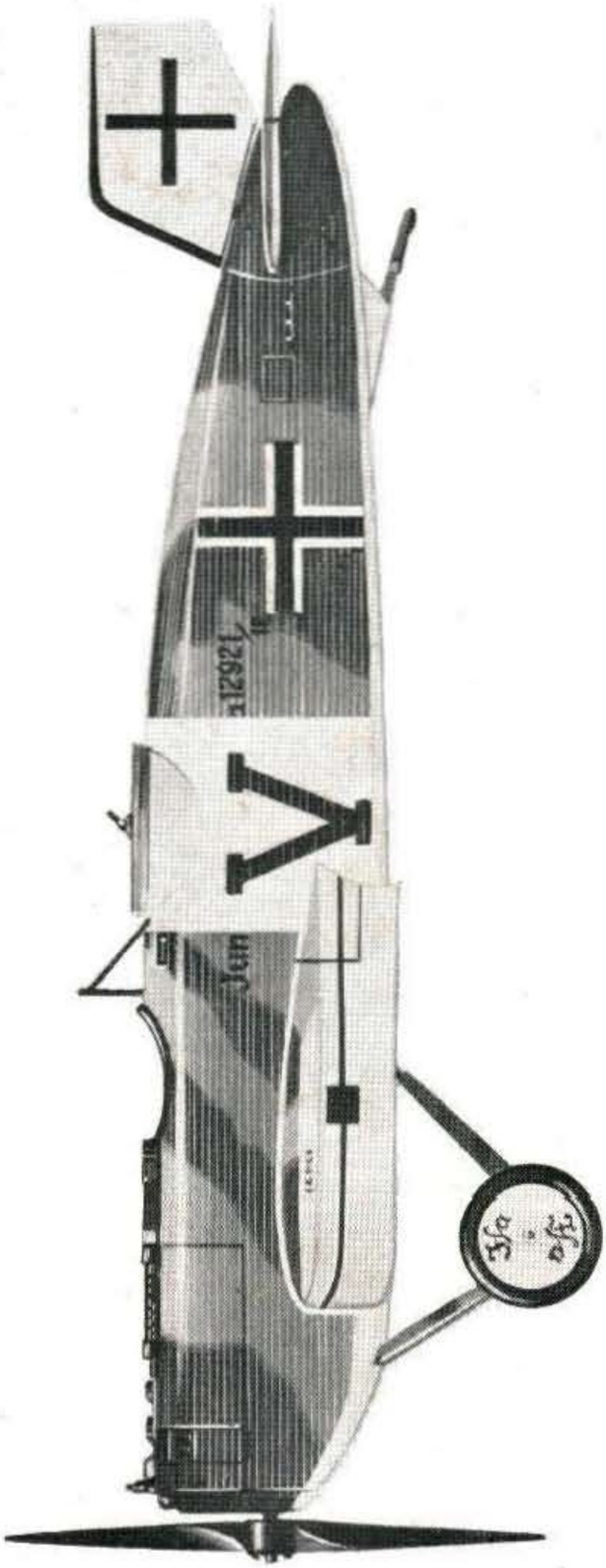
PROFILE PUBLICATIONS

The Junkers Monoplanes



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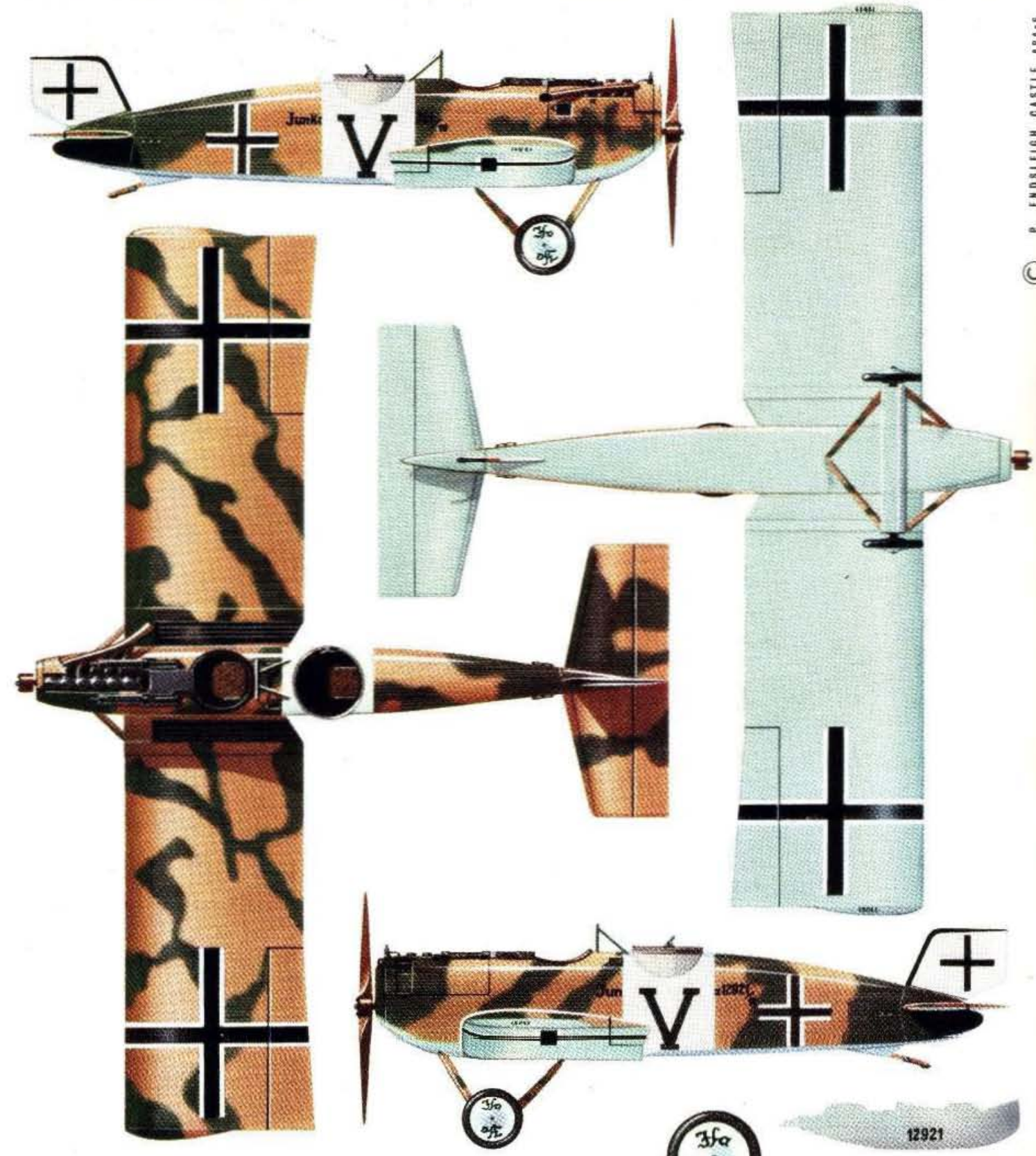

(Left) wheel disc detail; and (above) serial under wingtip.

JUNKERS J.10/CL.I, 12921/18, thought to have operated with the *Geschwader Sachenberg* from Peterfeld airfield on operations over Kurland (Lithuania) in early 1919. Note the fuselage stencil obscured by white band: "Junk CLI Jfa 12921/18".

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The Junkers Monoplanes

by Hugh Cowin

The elegant lines of the Junkers J-1 are shown to advantage in this view: note the extremely advanced underslung radiator built to Professor Junkers' own patent. (Unless otherwise indicated, all photographs appearing in this Profile *are from the author's collection.)*

Although there can be no question about the tremendous impetus given to the world-wide growth of aviation as a direct result of the First World War, it is nevertheless true to say that during that period development in applied aerodynamics stood still. Only in Germany can any real attempt be seen to have been made in advancing the basic state of aircraft development during this period, and this stemmed largely from the work of one design team under the direction of Professor Hugo Junkers.

In his book *The Aeroplane: An Historical Survey*, Mr. Charles H. Gibbs-Smith singles out Hugo Junkers' successful development of the thick sectioned cantilever wing and the all-metal monoplane as being, perhaps, the most vital and far reaching innovations of their day. Hugo Junkers was born on the 3rd February, 1859, at Rheydt, near Dusseldorf, and after graduating from the Berlin Technical High School he gained his first industrial experience as personal assistant to the founder of a large gas company in Dessau. Given responsibility for the development of gas engines, he soon gained widespread prominence in this field, and by 1895 he formed his own firm, the IKO Heating Apparatus Company. In 1897 he accepted the chair of Professor in Thermodynamics at Aachen University and it was there, several years later, that he met Professor Reissner and was introduced to the new and fascinating possibilities of heavier-than-air flight. In 1907 Reissner invited Junkers to collaborate with him in the design and construction of a canard (tail first) monoplane which eventually flew in 1909, albeit without much attendant success. By now, however, Junkers had definite ideas of his own on aircraft design and in February, 1910, he took out a patent for a fully cantilevered thick aerofoil section tailless aircraft of unprecedented size.

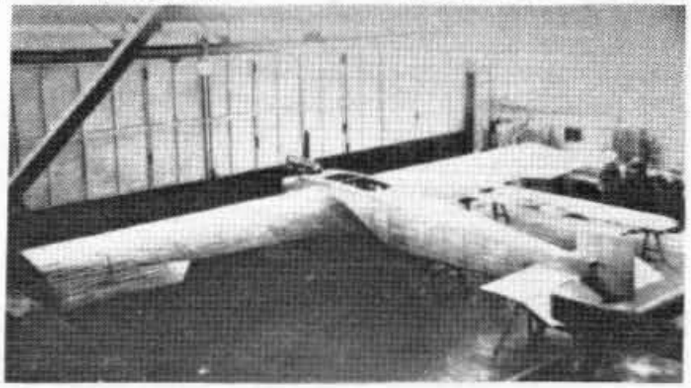
Junkers gained a financial grant with which to construct a wind tunnel for his facility at Aachen, and with this he began the aerodynamic research programme which lead, five years later, to the elegantly simple lines of the J-1 monoplane. He resigned his post at Aachen in 1911 in order to devote himself more fully to the running of his own firm in Dessau where, on his return, he lost little time in having his own wind tunnel erected. However, owing to his preoccupation with the development of his diesel engines and the setting up of the Jumo works to handle this effort, it was not until early 1915 that Junkers was able, once more, to devote much thought to aircraft construction. His first action at this time was to open his own research institute, the *Forschungsanstalt Professor Junkers*, with special responsibility for the design and development of a series of fully cantilevered all-metal monoplanes.

THE DERIDED TIN DONKEY

Designed by the three man team of Hugo Junkers, Dr. Mader and Otto Reuter, the Junkers J-1 was initiated as a purely private venture, with tooling up for the sole example being put under way on the 8th June 1915. Contrary to the popularly held misconceptions that this aircraft was drawn up to meet a similar requirement to that filled by the series of Fokker Eindeckers, and was, therefore, a single seater, the J-1 was, in fact, specifically intended to serve as a pure in-flight research tool for use in developing a later line of all-metal, cantilevered monoplane fighters, and as such, the J-1, while often flown solo, was provided with a second seat immediately forward of the pilot, enabling a flight test observer to be carried when required.

In its appearance, the J-1 was an exceptionally clean and well proportioned mid-winged monoplane that incorporated an unprecedented number of very advanced features within its design. Built entirely

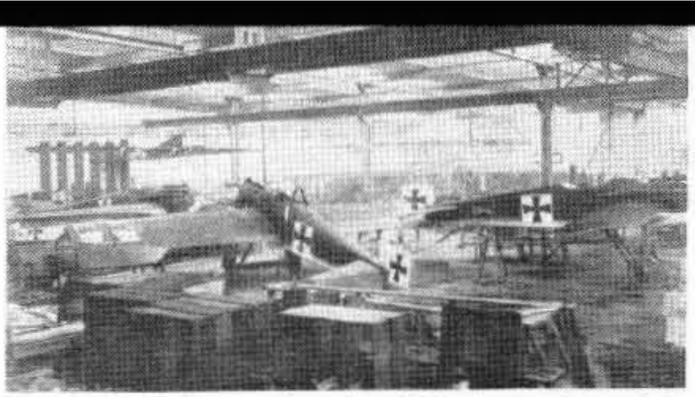
Photographed immediately prior to roll-out, the J-1 displays the elongated cockpit with its provision for a flight test observer forward of the pilot. (Photo: Peter M. Grosz.)



The J-2, E 251/16, *immediately before wing mating; note semi-monocoque fuselage, fully-cowled engine and underslung radiator. Armament was to comprise a single synchronised Spandau partly faired into the upper starboard cowling.*
(Photo: Peter M. Bowers Collection)

Front view of E 252/16, *first of the modified J-2's; the pylon above the port wing carried pitot/static test instrumentation.*

from steel, the basic structure was formed around the centre fuselage section and the inboard stub wing structure that was integral to it. Onto this major structural element was hung the nose section, the patented Junkers sparless wings (built up by welding short span truss-tied sections successively outwards from the stub wing centre section) and, lastly, the rear fuselage and tail unit. Covering for the whole aircraft, including all control surfaces, was provided by welding sections of 2 mm thick sheet steel to the main 'L' and 'I' sectioned girders that comprised the actual airframe structure. Where air or structural loadings of any magnitude were anticipated, such as on parts of the wings and belly, the outer sheet panels were reinforced by the welding of an additional corrugated sheet to their inner surface to provide a greater degree of stiffness (this, incidentally, was one on the earliest practical examples of stressed skin construction to be used anywhere in the world). Following an initial test hop at Dessau on 12th December 1915, the J-1 was taken to the military aircraft testing grounds at Döberitz, on the outskirts of Berlin, for Service flight testing and evaluation. Quite naturally, military interest in the J-1 was to centre around the evaluation of its potential as a fighting aircraft and to this end many of the J-1's flights, whilst at Döberitz, were made in company with a Rumpler C.I, deemed to be the best service type available in a class comparable to the J-1. These comparative trials against the higher powered Rumpler biplane showed the J-1, with a maximum level speed of 106 m.p.h., to be some 7 m.p.h. faster and this speed advantage was to become more marked when both aircraft were put into a shallow dive. However, as an inevitable result of the J-1's 50% greater



Factory view, taken in November 1916, showing three of the four later version J-2's with the prototype E 250/16 (extreme left). (Photo: Peter M. Bowers Collection)

wing loading and lower power loading, both climbing performance and minimum flying speed comparisions came out markedly in favour of the biplane.

The Junkers J-1 was not beloved by the majority of those that either flew or serviced it. On the ground, its welded construction presented many problems never previously experienced, whilst in the air, its sluggishness on the climb, and poor forward and downward pilot visibility helped earn the aircraft such derogatory names as The Tin Donkey and Flying Urinal (after the cylindrical metal public urinals that had begun to appear in the streets of Berlin). However, despite the drawbacks implicit to the J-1, there were those, such as Anthony Fokker, who had himself test flown the J-1 from Döberitz, who pointed to the military advantages to be gained from the high speed and more rugged construction offered by the all-metal monoplane.

JUNKERS' FIRST FIGHTER

If the J-1's poor general handling qualities had provided Junkers' critics with plenty of ammunition, his next design, the single seat Junkers J-2 fighter, almost completely extinguished the already faltering military support for his radical proposals.

Ordered by the military whilst still in the drawing board stage, the J-2, although bearing only a superficial external resemblence to its predecessor, shared an essentially similar structure and differed only in its smaller overall size and greater aerodynamic refinement.

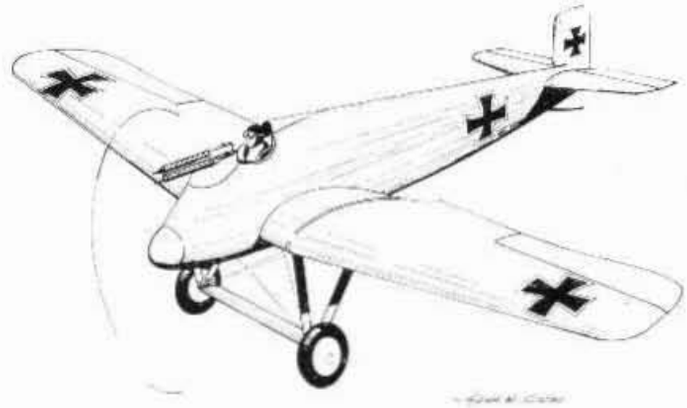
In its original form, the Junkers J-2 was, undoubtedly, the cleanest and most elegant aircraft ever to have appeared up to this time. Clearly, in designing the J-2, the Junkers team had chosen to place all their eggs into the one basket of aerodynamic cleanliness in their quest for improved performance, as evidenced by the adoption of smaller flying surfaces, semi-monocoque fuselage and a generally greater attention to fairing detail. Only in the design of the new and more rugged undercarriage can the Junkers design

E 252/16, *shortly before being "written off" on September 25th 1916. Note additional rudder area and extensively modified forward fuselage.*

staff be seen to have made any significant compromise towards meeting the utilitarian needs of everyday operation in and out of short, often rough, grass airfields.

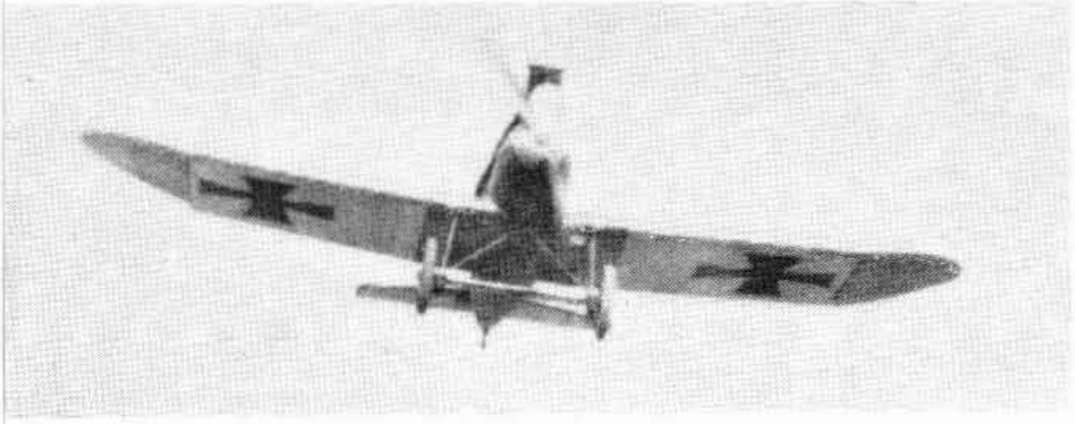
With a wingspan of 36 feet, 2 inches and a length of 23 feet, 11½ inches the J-2 was powered by a straight six, 120 h.p. water-cooled Daimler Mercedes D-II motor. Unfortunately, little or no control appears to have been exercised in limiting the growth of the J-2's all-up-weight, with the result that despite the overall smaller size of the J-2, its loaded weight exceeded that of the J-1 by no less than 308 lbs. This additional weight, coupled to the reduced wing area of the J-2 took its inevitable toll on both wing and power loadings and acted adversely on all major performance parameters, including that of top speed, which fell to 90·5 m.p.h.!

In all, Junkers were to build six examples of the J-2 for the German Army Air Corps during 1916, and as fighter types these aircraft were issued with the *Eindecker* serial numbers, E 250/16 to E 255/16. However, only two of these machines, E 250/16 and E 251/16 were to be built in the clean, initial form that incorporated armament, all the remaining machines having a remodelled and longer fuselage that appeared to make no provision for weapon installation. Of the six J-2s, E 251/16 appears to have been the first to fly, sometime during July 1916, and it was certainly this aircraft that was handed over to the military for initial type testing in the August of that year. These type tests soon confirmed Junkers' worst fears and showed the J-2 to have a performance generally inferior to the earlier J-1. To pilots used to flying the much more lightly wing loaded biplane, the J-2 must have presented a truely awesome prospect as a combat mount and clearly there was more than a little to justify claims that the machine handled with all the agility of a heavily laden freight train.



An impression of the projected J-5, clearly illustrating the excellent vision enjoyed by the pilot, seated high in the nose forward of the buried radial engine.

One of the criticisms raised about the type as tested in its original form alluded to the weakness of the crash pylon situated almost immediately to the rear of the cockpit. This criticism, in itself, however, could in no way justify the virtual redesign of the fuselage and the addition of greater rudder area that was incorporated in E 252/16 and the subsequent three aircraft that together formed the second variant of the design. What is probably far more likely was that the particular short nosed initial version proved to be both somewhat tail heavy and directionally unstable in flight, necessitating the noses of the latter four machines, still under construction, to be lengthened by some 5½ inches. The first example of the latter J-2 variant, E 252/16 flew for the first time on 20th September 1916, but was "written-off" after crashing five days later whilst being flown by Lt. Schade and this mishap appears to have signalled the end of military interest in the Junkers J-2.



THE STILLBORN J-3

Junkers' next design, the J-3, was to have been offered in both single seat fighter and twin seat fighter/bomber forms, alternative engine installations of either a 160 h.p. water-cooled in-line, or the 160 h.p. twin bank Oberursel air-cooled rotary being proposed in both categories. Detail design of this machine was completed but construction of a prototype J-3 airframe ceased almost immediately following the crash of the modified J-2 on 25th September 1916 and the sole, partially completed J-3 airframe was relegated to serving as a display piece in the exhibition hall of Junkers own plant at Dessau.

(Left, above) *The novel pivoting wingtip controls are discernable in this rare view of the J-7 in flight.*
(Photo: Peter M. Bowers Collection)

(Left, below) *The sole J-7 in its original form, just before the first flight on September 13th 1917.*
(Photo: Peter M. Bowers Collection)

BIPLANE BREAKTHROUGH

Oddly enough, it was through the design and construction of a biplane, or more properly, the Junkers J-4 sesquiplane (confusingly designated J-I by the Army), that the Junkers designers were to find the solution to the problem of producing a practical all-metal monoplane. Towards the close of 1916, Junkers, in company with AEG and Albatros had each received a copy of a seemingly impossible Army requirement for a tactical reconnaissance and close support aircraft. The specification demanded a heavily-armoured two-seater biplane and in order to meet it Junkers had to reject all steel construction in favour of an airframe that could make the best use of the light metal alloys, already successfully applied by Dr. Claudius Dornier in the design of his series of giant flying boats. Fortunately, Junkers had already commenced research into the use of these light metals and this work was rapidly and successfully applied to the design of the J-4, whose vulnerable sections were built from armoured steel, whilst less critical areas employed Duralumin throughout. These lessons in the extensive use of light metal construction were soon to prove of invaluable help in the development of the later Junkers monoplanes.

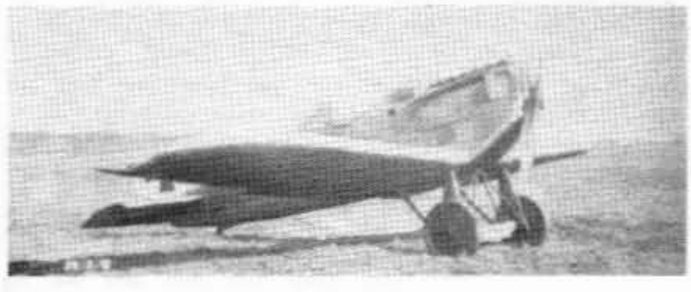
THE JUNKERS' R-PLANE PROJECT

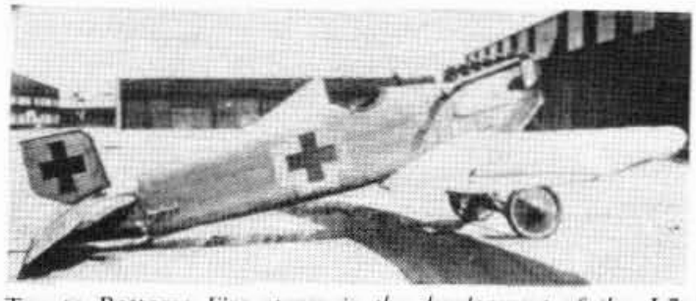
The beginning of 1917 found much of Junkers aircraft effort occupied with the development of the J-4, which, as the winner of the Army design contest, had been ordered into large scale production. This work, however, did not prevent the Junkers design staff from evolving further monoplane studies, and the next of these, to meet an Army requirement for a second generation R-Plane, was commenced towards the end of January 1917. Junkers submission to this requirement took the form of a remarkably advanced four engined monoplane day bomber design with a wingspan of 112 feet 4 inches and a length of 73 feet 2 inches. Designed to be built almost completely from dural, the estimated all-up-weight of the Junkers R-I came out at a modest 22,050 lbs. Performance estimates indicated that the bomber should be able to operate over a radius of action exceeding 380 miles with a bomb load of 3,300 lbs. Clearly, with its estimated top speed of 112 m.p.h., a ceiling of 17,000 feet and its heavy defensive armament of seven movable machine guns, the Junkers R.I would have proven a formidable quarry for the still quite embryonic Allied fighter defences. Fortunately for the Allies, the R.I was to run into a number of protracted development problems and thus whilst two prototypes of the R.I had been ordered by the autumn of 1917 (serial nos. R 57/17 and R 58/17), construction of the first machine was still incomplete at the time of the Allied Technical Control Commission's arrival at the Junkers plant in the late spring of 1919.

MORE MONOPLANES ON PAPER

The next two monoplane fighter studies, drawn up between July and September 1917, did not progress beyond the drawing board stage. The first of these projects, the Junkers J-5 low-wing monoplane was an attempt to produce the lightest possible airframe (which would enhance the handling qualities of the fighter), whilst affording the pilot a maximum field of vision forwards and downwards. To do this, the Junkers design staff chose the novel solution of mounting the air-cooled rotary engine well back within the centre section of the fuselage, thus permitting the cockpit to be positioned in the nose, forward of the engine. Large curved cut-outs were made in the inboard trailing edges of the low mounted wings in a further effort to improve pilot visibility in the downward and rearward arc. In marked contrast to the J-5 project, the single seat J-6 parasol winged fighter study was of quite conventional appearance.

Almost directly comparable in weights and dimensions with the somewhat later rotary powered Fokker





Top to Bottom: *Five stages in the development of the J-7; October 1917, with short-span ailerons and retaining overhead radiator; January 1918, with car-type radiator, and interim J-8 type outer wing panels, incorporated during major redesign work following Fokker's crash in the machine; February 1918, with J-6 type outer wing panels, which were to be the definitive units for both the J-7 and its production successor, the J-9/D.I; March 1918, showing resemblance to short-fuselage J-9; and final form of the J-7 with slightly taller rudder.*
(Photos: the author, Peter M. Bowers, J. M. Bruce, Peter M. Grosz, Peter M. Grosz.)

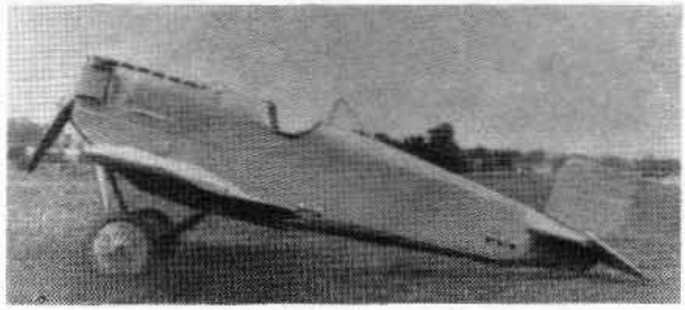
V.28/D-VIII fighter, the J-6 was to have used the more powerful 160 h.p. Siemens Sh.3 air-cooled radial engine, which in combination with the J-6's slightly lower wing loading, should have given the Junkers design a degree of ascendancy in both top speed and general handling over that of the Fokker aircraft, especially at lower altitudes.

FOKKER AND THE J-7

Junkers' next design was the J-7 single seat experimental fighter which was first flown during the first half of September 1917, and which ultimately proved to be a further major technical advance, comparable only to that of the earlier J-1 of 1915.

In the design of the J-7, the Junkers team embodied many of the more promising design features of the J-3, J-4 and J-6 and in so doing put themselves in danger of repeating the errors which had led to the failure of the J-2 *Eindecker*. In its construction, the J-7 married the low wing layout first proposed in the J-3 with the riveted light metal structure evolved for the J-4. As initially flown, the J-7 made use of a novel system of pivoting wingtips in place of normal ailerons but as this form of control proved to be far too positive in its operation as well as being prone to "flutter", early plans were made to replace the original J-7 outer wing panels with those designed for the J-6 parasol study. One of the biggest puzzles surrounding the J-7 in its original form centred around the choice of the cumbersome radiator design. Certainly, it was this that was in a large part responsible for the J-7's poor initial performance.

The sole unarmed J-8 which served as the prototype for the J-10/C1.I, the first real success in the Junkers all-metal monoplane series. Note horn-balanced ailerons, replaced by shorter span tapered chord surfaces on the production J-10.
(Photo: Peter M. Grosz)



Unarmed prototype J-9/D.I single seat fighter showing relocation of undercarriage attachment points and cleaned-up upper fuselage contours. Note "Jfa" legend on wheel disc, denoting "Junkers-Fokker A.G." (Photo: via J. M. Bruce)

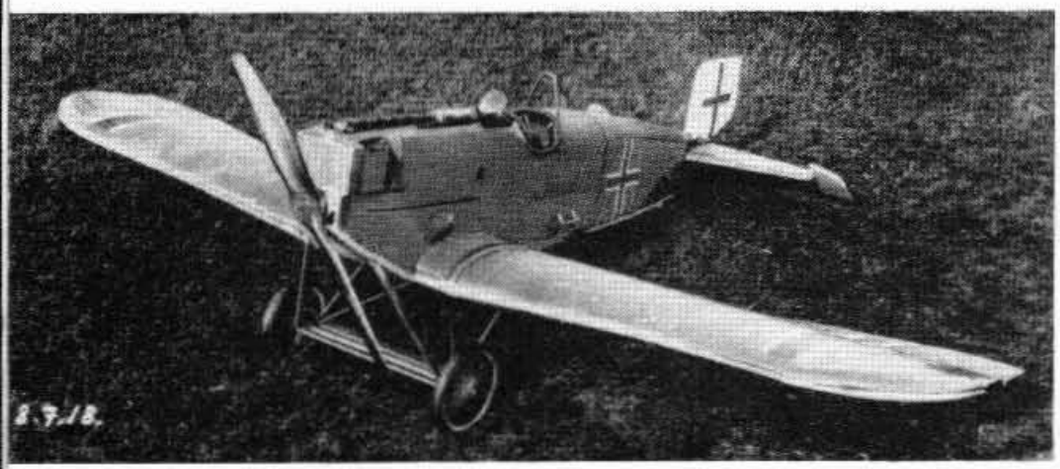
One of the early batch of long-fuselaged J-9's, this machine was fitted with a higher-powered Benz Bz IIIa engine developing 200 h.p. Note underwing radiators. (Photo: via J. M. Bruce)

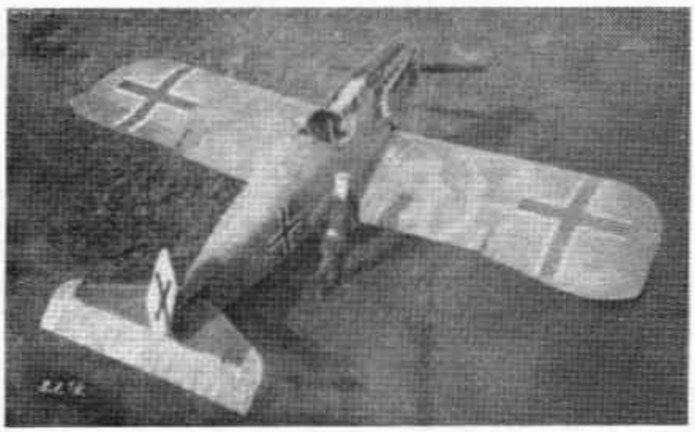
Initial flight testing of the J-7 soon proved the inadequacies of the pivoting wingtip system and this was replaced early in October 1917 by an interim modification to the outer wing panels, which now carried short span ailerons in place of the fully movable tips. Why rapid remedial steps were not taken at this point to improve upon the design of the radiator remains a mystery and surprisingly, the J-7 was to retain the original radiator up to the time that it was virtually "written-off" in early December 1917, whilst being test flown by Anthony Fokker.

This mention of Fokker, who had already achieved international fame as both a leading aircraft constructor and test pilot brings the writer to the point where he must digress for a moment to touch upon the uneasy association of the Junkers and Fokker interests that had been forced upon Professor Junkers as a result of government pressure. By the summer of 1917, the production of the heavily armoured J-4 aircraft had begun to run into a number of problems which threatened to produce a bottleneck to the supply of these badly needed machines. As a person, Professor Junkers had long been known for his radical left wing views and as such was considered gravely suspect by the German military high command. The latter acted swiftly and decreed that Junkers amalgamate his aircraft interests with those of Fokker. Thus, on the 20th October 1917, was formed the *Junkers Fokker Werke, A.G.* of Dessau. The reason for the choice of Fokker is obscure, particularly in view of the much more closely related work being carried out by Dornier, and probably owed much more to the Dutchman's not inconsiderable self-salesmanship than to any technically defensible consideration. It is not surprising that in the circumstances little or no contact subsequently existed between the two heads of the new company, whose approach to aircraft construction and very way of life were at such variance. Clearly, the forced merger did little to increase the production of the J-4 or any of the subsequent Junkers designs ordered into service. However, the merger itself was to prove shortlived, coming to an end a little more than a year later when Fokker fled Germany for the sanctuaryof his native Holland immediately following the Armistice.

THE CHANGELING J-7 AND J-8

Ironically, it was the crashing of the sole J-7, whilst the machine was being flown by Fokker, that was to remove the last barrier to the realization of a truely practical Junkers all-metal monoplane type, for as a result of the mishap, Junkers was provided with a brief but vital period in which to carry out a major programme of modification to the machine. Junkers, himself, had never been quite satisfied with the armoured J-4 machine, which whilst being almost invulnerable to both ground and air fire, proved slow and cumbersome to handle and his thoughts turned more and more to the thought of producing a light, faster machine to replace it. To meet this requirement, the Junkers design team had initiated work on a two seat monoplane, the J-8, towards the close of October 1917 and many of the J-8 design features were to find their way into the re-built J-7 that was to reappear in its new guise in time to take part in the first of the Army fighter competitions, held in January 1918.





Two views of an early short-fuselaged J-9 showing twin Spandau installation.

The re-built J-7 leant very heavily indeed upon the design features devised for its bigger brother and both the J-7 and J-8 aircraft were readied in time to put in an appearance at the Army trials, held towards the close of the month. However, even here the J-7 appeared to be dogged by bad luck and retired from the trial on the 22nd January, having suffered damage as a result of the propeller breaking up during gliding trials, again whilst in the hands of Anthony Fokker.

It should be mentioned here that the fitting of the square cut J-8 type outboard wing panels to the sole J-7 was again something of an interim move and by the beginning of February 1918, the J-7 had been further modified to carry the J-6 type outboard panels that were to become the definitive form not only for the J-7, but also for its production version, the J-9 fighter. The incorporation of these J-6 type panels represented the last major modification carried out to the J-7, now able to achieve a top level speed of 127·5 m.p.h. and warranted favourable reports on both the greatly improved pilot visibility and general handling. The only criticism now appeared to centre around a slight degree of lateral instability. At the beginning of April 1918, a new slightly taller and higher aspect ratio rudder was fitted to the sole J-7 in an attempt to cure the directional instability—a problem that was not to be satisfactorily overcome until later in the year with the introduction of the lengthened fuselages on the production J-9.

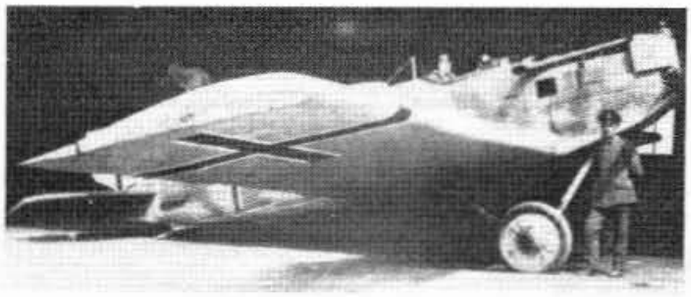
MONOPLANES FOR A BI-FOCAL ARMY

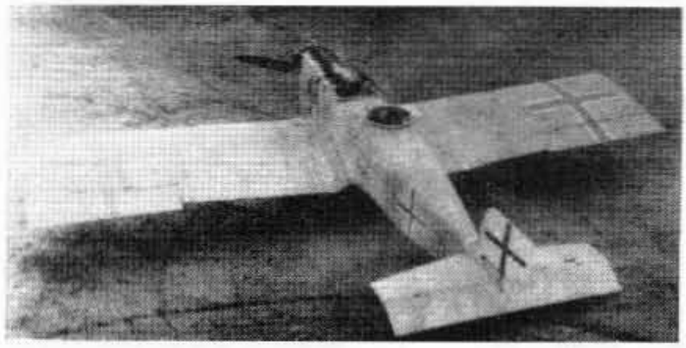
Although the success of the re-designed J-7 had, by the spring of 1918, guaranteed continued military interest in the production fighter version of the basic design, by now given the maker's designation J-9, it is of interest to note that the monoplane concept had found such disfavour with the military that the *Eindecker* designation had by now lapsed, with the result that the Army ordered the J-9 under their designation of Junk. D.I, the D being an abbreviation of *Doppledecker*, or literally, Biplane. Notwithstanding, the unarmed J-9 prototype stubbornly refused to sprout a second set of mainplanes and must remain as one of the most flagrant breaches of official nomenclature on record.

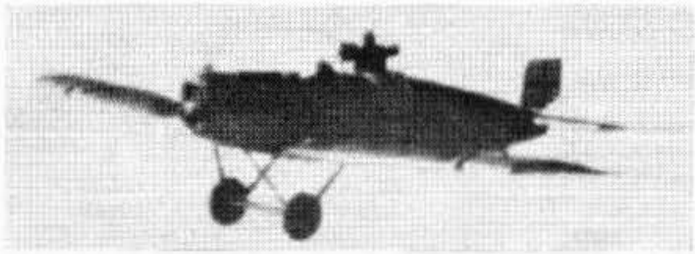
Rolled out at the end of April 1918, the J-9 closely resembled its forebear's definitive form, but in place of the J-7's 160h.p. Mercedes, the production fighter now carried a 185 h.p. B.M.W. motor and the whole of the aircraft's centre section had undergone extensive strengthening to match the increased power. Flight testing of the small batch of pre-production J-9s continued through the summer of 1918, during which at least one machine was flown with an extended rear fuselage in an attempt to overcome the still apparent lack of directional stability first experienced with the J-7. One other interesting modification carried out as part of the flight test programme was that of re-engining one of the long fuselaged J-9s with a 200 h.p. Benz Bz IIIb water-cooled engine, which required the addition of sizable underslung wing radiators. Such was the urgency attached to producing fighters capable of countering the increasing numerical superiority of the Allies' fighter forces that, in the case of the J-9, production was put under way prior to the completion of flight testing. In all some forty-one J-9/D.I were to be built, the majority being built after the signing of the Armistice during the five or six month period prior to the arrival of the Allied Technical Control Commission team at Dessau. Of the few J-9s to reach the Western Front during the last month of fighting, little or no opportunity existed to carry out a proper combat evaluation of the type. For the most part, the operational careers of the J-9/D.I fighters were limited to their employment in the fighting against Poland that continued after the signing of the Armistice. In this

Two long-fuselaged J-9/D.I's; (Above) *a machine used for service evaluation trials, with the standard 185 h.p. B.M.W.IIIa engine; and* (Below) *one of the few aircraft to reach the Western Front, this machine carries a non-standard windscreen to protect its occupant from the blast of propeller wash.*

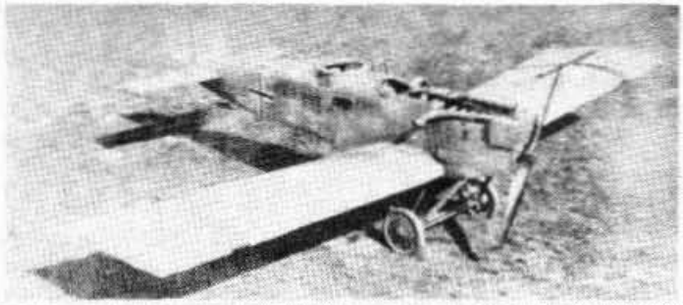
(Photos: Peter M. Grosz)

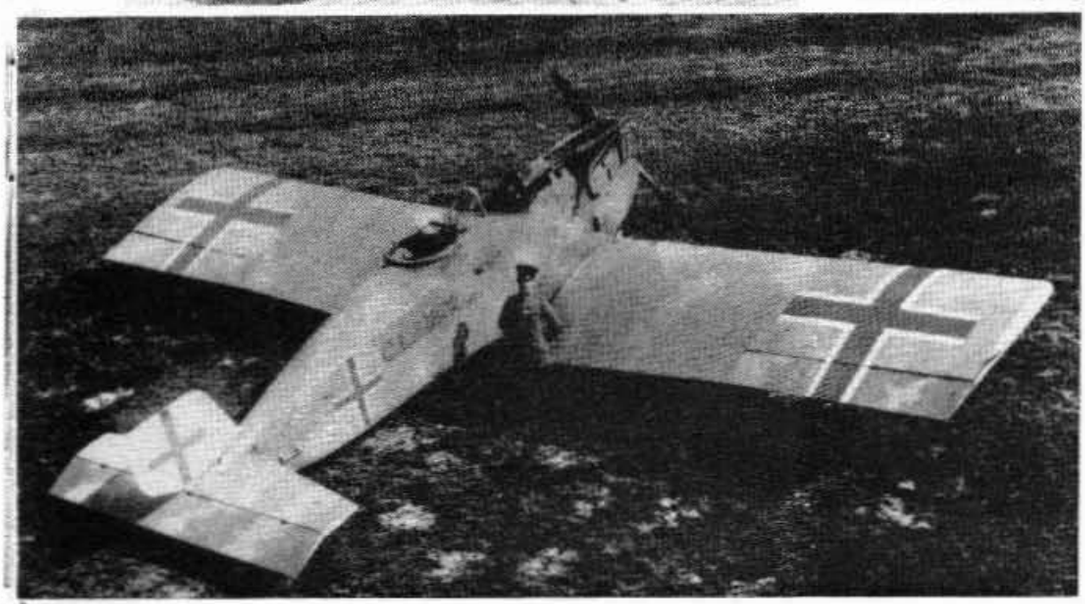






(Top) *C1.I serial* 15672/18, *based at Brieg and operated against the Poles in the spring of 1919; and* (Middle) *the same machine at a later date, when it was shipped to Japan in company with a J-4 as part of the German reparations imposed by the Allies.* (Bottom), *a rare in-flight photograph of one of the J-10's of the* Geschwader Sachenberg *during operations over Kurland in early 1919; in the original print it is possible to distinguish a black capital M marked on a white fuselage band in similar style to the markings of the aircraft depicted on page 2 of this* Profile. (Photos: Peter M. Grosz)





Photographed on January 21st 1919, this "short" J-9/D.I was still basically airworthy after three months abandoned in the open. The strength of the type may be judged by the fact that four Fokker D.VII's on the same Belgian airfield had deteriorated so badly as to be totally unrepairable. (Photo: Peter M. Grosz)

theatre of operations, J-9s operated from both Wainoden and Swinemunde, the J-9s of the latter airfield being operated as an element of the renowned *Geschwader Sachenberg*, one of the most prominent and feared wings of the German Naval Air Service.

THE J-10; A SWORD AND A PLOUGHSHARE

Following the successful debut of the sole J-8 at the fighter trials of January 1918, development of a production version of this two seat escort and ground attack fighter, to be designated the J-10 by Junkers and the C1.I by the Army, was pressed ahead with some vigour. The evolution of the production J-10 paralleled closely that of the single seat J-9, with the same undercarriage and re-engining modifications being carried out on the prototype J-10 as had occured with the J-9. Flown for the first time in May 1918, the prototype J-10, serialled C1.I 1803/18 carried no armament and was virtually indistinguishable from the earlier J-8 in all external detail other than its revised undercarriage and tapered chord ailerons which replaced the constant chord, horn balanced ailerons employed on the J-8.

The development of the J-10 appears to have run more smoothly than that of J-9, with the J-10 appearing to have found widespread favour amongst the military as being the logical replacement for the Halberstadt C1.IVs that equipped the majority of ground attack squadrons. As with the J-9 single seat fighter, production of the forty-three Junkers J-10/C1.Is came too late, and was too small to have any effect in the air battles over the Western Front; and consequently the type was pressed into service with units operating against both Poland and the Russian contingents opposing Germany in the Baltic States. The J-10/C1.Is were known to have been flown from at least three eastern airfields during the period up to June 1919, being stationed at Wainoden, Brieg in Poland and Peterfeld in Lithuania. It is interesting to note that almost all of the C1.Is operated on the Eastern Front were late production machines, which differed from earlier models in having their single fixed forward firing Spandau, mounted on the port side

(Left, above and below) *Note the single forward-firing gun and short span tapered chord ailerons in these views of J-10/C1.I serial* 1802/18.

(Above) *The first of three Junkers J-11 floatplanes constructed for the German Navy; note low aspect ratio rudder, and incorrect fuselage legend* "Junk.C.". *The correct form should have read* 'Junk.C3MG 7501/18". (Below) *A J-11/C3MG photographed in spring, 1919, with taller, definitive, rudder. Lack of armament and presence of British Naval officer (in white cap-cover) suggests that this was one of the hundred aircraft that the German Navy was permitted to retain for mine-spotting patrols.*

(Photos: the author, Peter M. Grosz)

of the engine cowling, supplemented by the addition of a second fixed gun, mounted to starboard. Protection from quarter and rearward attack on all C1.Is was provided by a flexibly mounted Parabellum gun.

The operational career of the Junkers C1.I appears to have been comparatively short lived, many of the machines falling under the axes of the Allied Technical Control Commission as it made its ponderous way eastwards during the spring and summer of 1919. Professor Junkers did, however, manage to postpone the fate of four J-10s by the simple expedient of deleting the armament and turret whilst still on the production line and equipping the machines with a fully enclosed, if somewhat rudimentary form of cabin for a passenger who was to sit in the position formerly occupied by the gunner. These civilianised J-10 formed the first of Professor Junkers' excursions into both the design and operation of commercial aircraft, and operated for a period of three to four months over the Dessau-Weimar route.

THE JUNKERS J-11

The Junkers J-11, a twin-float-equipped derivation of the basic J-10 design, was the only other Junkers wartime project to actually be built, and all three of these machines, designated C3MG by the German Navy, were to be delivered for naval evaluation. Actually, only the first of the three J-11 was to be delivered before the signing of the Armistice, but the tests that were conducted with the J-11 showed the machine performance to be, in fact, inferior in many respects to that of the Brandenberg floatplanes already in operational service with the German Navy.

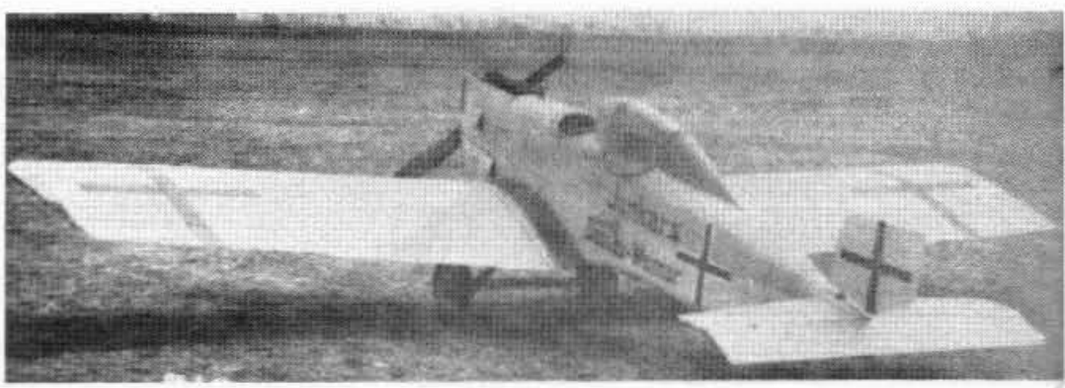
Powered by a 185 h.p. Benz water-cooled engine, the J-11 incorporated additional wing area in the form of an extended wing centre section and consequently its all-up-weight was some 1,000 lbs. greater than that of the J-10. The resulting drop in performance was inevitable and tests with the J-11 showed it to have a very modest top speed of 108 m.p.h. and a time of more than 26 minutes to reach 10,000 ft. The initial disappointing performance of the J-11, like many others of Professor Junkers early monoplanes could be attributed to the central fact that virtually all of these designs outstripped the engine development work being undertaken in Germany during this period and it is pertinent to note that later, when the J-11 was resurrected as the Junkers A-20, powered by a 300 h.p. Hispano motor and built under license in Russia, its top speed and general performance make it one of the most successful aircraft operated in this, one of the world's most hostile natural environments.

Notes on colour schemes applied to Junkers Monoplanes

Contrary to the widely held notion that all German military aircraft finishes complied to the multi-coloured lozenge type camouflage schemes drawn up at the beginning of 1916, the Junkers aircraft for the most part carried highly individualised finishes of an irregular pattern.

The only Junkers type to carry the basic lozenge scheme was the unsuccessful J-2 Eindecker of 1916, and even this machine sported the familiar lozenge camouflage on the upper surfaces of its wings only, whilst the fuselage remained finished over its upper surfaces in a drab olive that merged with the sky blue used on all undersurfaces.

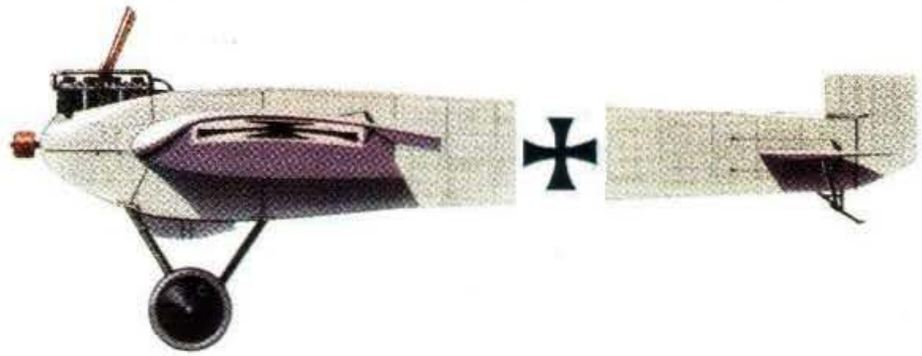
Colour schemes adopted for the J-9 and J-10s, whilst following the same basic irregular strip pattern, varied enormously. The upper surfaces of some aircraft were finished in a mixture of earth brown and drab olive, whilst others used a mixture of slate grey and drab olive. To add to the general confusion,



One of the "civilianized" J-10's used as passenger transports between Dessau and Weimar, photographed in March 1919. Considering the level of engine noise and restricted visibility, it is said that few fare-paying passengers ventured aloft a second time in this aircraft.

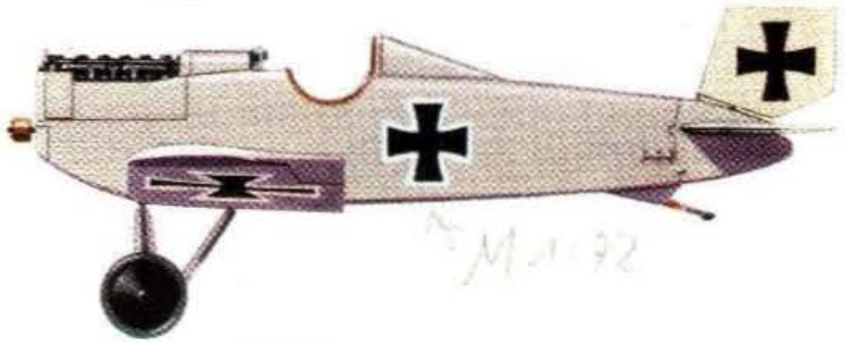
(Photo: Peter M. Grosz)

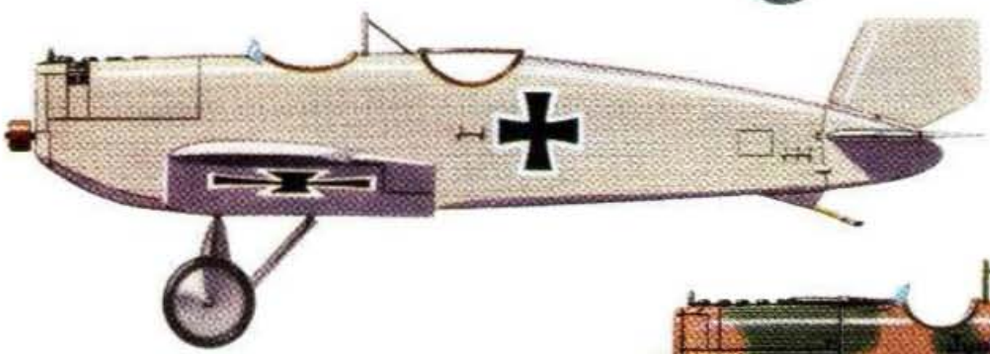
Junkers J.1 (120 h.p. Daimler Mercedes D II) flown at Döberitz in December 1915 by Ltn. Mallinkrodt.



Junkers J.2, E 251/16, with single forward-firing machine gun; July 1916.

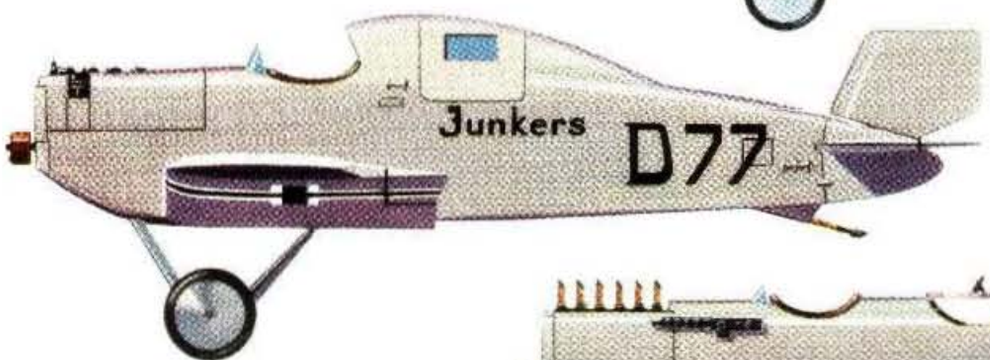
Junkers J.7, with engine installation as it appeared after January 1918.





Junkers J.8.

Junkers J.9/D.I, 5180/18.



Junkers J.10, civil conversion.

Junkers J.11, seaplane with early fin and rudder configuration.

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TABLE OF MAIN DIMENSIONAL AND PERFORMANCE CHARACTERISTICS OF THE EARLY JUNKERS MONOPLANE DESIGNS, 1915—1918

Junkers Type No.	Military Designation	Number Built	First Flown	Role	Motor	Power (h.p.)	Dimensions Span	Dimensions Length	Wing Area (sq.ft.)	Weight (lbs.) Empty	Weight (lbs.) Loaded	Wing Loading (lbs./sq. ft.)	Top Speed (m.p.h.)	Service Ceiling (ft.)	Armament or payload
J-1	None	1	12.12.15	Research	1. Daimler Mercedes D.II	120	42′ 6″	28′ 4″	257	1,986	2,247	8·75	105·5		Provision to carry test observer.
J-2 (Early)	Junk.E	2	.7.16	Single Seat Fighter	1. Daimler Mercedes D.II	120	36′ 2″	23′ 11½″	213·5	2,040	2,555	12	90·5	14,700	1 fixed, forward firing Spandau.
J-2 (Late)	Junk.E	4	.9.16	Single Seat Fighter	1. Daimler Mercedes D.II	120	36′ 2″	24′ 5″	213·5						None fitted.
J-3	None	Part built late '16	Not flown	Single Seat Fighter	1. Oberursel	160	37′ 7″	21′ 10½″	226		1,705	7·5		21,250	1 fixed, forward firing Spandau.
J-5	None	Project early '17	Not built	Single Seat Fighter	1. Oberursel	110	27′ 6″	20′ 9″	128						2 fixed, forward firing Spandau.
J-6	None	Project mid '17	Not built	Single Seat Fighter	1. Siemens Sh.3	160	26′ 2″	18′ 4″	128	1,430					2 fixed, forward firing Spandau.
Not Known	Junk.R.I	Part built '17-'19	Not flown	Heavy Daylight Bomber	4. Daimler Mercedes D.IVA	260 each	112′ 4″	73′ 2″	2,150	13,230	22,050	10·4	112	17,060	7 flexible Parabellum 3,300 lbs. bombload.
J-7 (Early)	None	1	13.9.17	Single Seat Fighter Prototype	1. Daimler Mercedes D.III	160	29′ 6″	21′ 11½″	126	1,275	1,700	13·5			None fitted.
J-7 (Late)	None	Convert	.4.18	Single Seat Fighter Prototype	1. Daimler Mercedes D.IIIA	165	29′ 6″	21′ 11½″	159·5				127·5		None fitted.
J-8	None	1	2.1.18	Two Seat Fighter Prototype	1. Daimler Mercedes D.III	160	40′ 7″	25′ 10½″	253	1,560	2,320	9·2	116		None fitted.
J-9 (Early)	Junk.D.I	41	.5.18	Single Seat Fighter	1. B.M.W. IIIA	185	29′ 6″	21′ 11½″	159·5				149		2 fixed, forward firing Spandau.
J-9 (Late)	Junk.D.I		.7.18	Single Seat Fighter	1. B.M.W. IIIA	185	29′ 6″	23′ 10″	159·5	1,420	1,840	11·5	145	19,700	2 fixed, forward firing Spandau.
J-10	Junk.C1.I	43	.5.18	Two Seat Ground Attack	1. B.M.W. IIIA	185	36′ 1¼″	25′ 10½″	233	1,620	2,345	10	118	17,000	1 fixed, forward firing Spandau (later aircraft had 2 Spandau) 1 flexible Parabellum.
J-10 (Civil)	None	4	.3.19	Passenger Transport	1. B.M.W. IIIA	185	36′ 1¼″	25′ 10½″	233				120		1 passenger carried in cabin.
J-11	Junk. C3MG	3	.10.18	Two seat Floatplane Fighter Scout	1. Benz Bz.III	185	42′ 0″	27′ 10″	290	2,015	3,150	10·85	108·5		2 fixed, forward firing Spandau 1 flexible Parabellum.

as will be seen from an inspection of the various photographs contained in this work, there appears to have been no attempt made to standardise even the basic geometry of the irregular patterns, with the result that even this varied considerably from machine to machine.

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